Sandia Decon Formulation for Mitigation and Decontamination of Chemical and Biological Warfare Agents

Test Results

April 2002

Sandia National Laboratories

"...exceptional service in the national interest."

Technology Description

In response to a national initiative to combat the domestic chemical and biological warfare (CBW) threat, Sandia National Laboratories (SNL) has developed Sandia Decon Formulation for mitigation and decontamination of chemical and biological (CB) agents. Sandia Decon Formulation can be deployed as a foam, liquid spray, or fog. Experimental results indicate that the formulation works quickly, is effective against both chemical and biological agents, and does not generate toxic by-products.

Performance against Chemical Warfare Agents

In SNL tests of Sandia Decon Formulation performance against chemical warfare (CW) agent simulants, half-lives for the decontamination of the simulants were on the order of minutes. Also, nuclear magnetic resonance (NMR) studies demonstrated that destruction of the CW simulants occurred without formation of potentially toxic by-products. The simulant test results were confirmed by a facility licensed to perform live CW agent testing. The formulation was deployed as foam, and the half-lives for the decontamination of the live CW agents were on the order of 2 to 60 minutes (Figure 1).

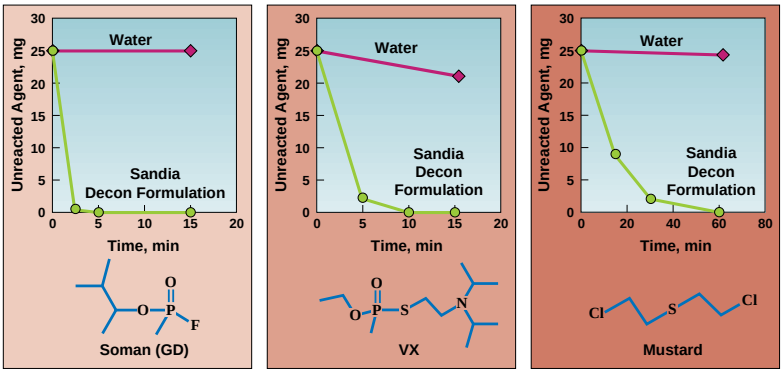

Figure 1. Decon of GD, VX, and HD (25 mg of agent on 25 cm² of paper)

Performance against Biological Warfare Agents

Three biological agent simulants were used in SNL tests of the formulation's decontamination performance: *Bacillus globigii* (a simulant for anthrax spores), *Erwinia herbicola* (a simulant for vegetative bacterial cells), and MS-2 *bacteriophage* (a simulant for viruses). For the *B. globigii* spores, a 7-log kill was obtained in an hour. Similar results were achieved for the vegetative bacterial cells and the viruses in 15 and 30 minutes, respectively. The simulant test results were confirmed by a facility licensed

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National Nuclear Security Administration

to perform live agent testing of anthrax. In a solution test (i.e., the spores were added to the formulation), a 7-log kill was achieved during a one-hour exposure period (Figure 2).

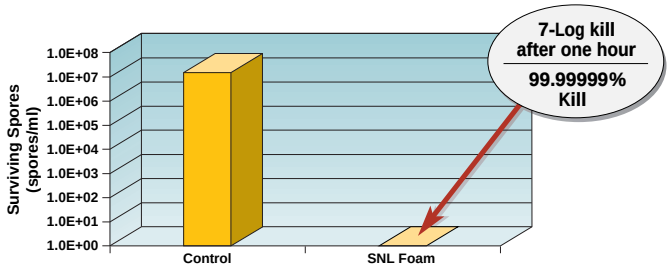

Figure 2. Anthrax spore kill

Performance on Substrates

In a test of the effectiveness of the Sandia Decon Formulation on decontaminating a variety of substrate surfaces and orientations, the foam was deployed on seven different substrates. In these tests, the G-agent simulant (diphenyl chlorophosphate) was used. After exposure to the foam for 15 minutes, less than 5 mg of unreacted simulant on each substrate remained.

Figure 3. Test room used for decontamination of anthrax simulant

Military Tests

The Sandia Decon Formulation was submitted to the Edgewood Chemical Biological Center (ECBC) at the U.S. Army Aberdeen Proving Grounds in Maryland for a study sponsored by the Department of Defense. Included in the study was a small-scale reaction rate test in which the liquid Sandia Decon Formulation completely destroyed chemical agents GD (soman) and VX within 10 minutes, and HD (mustard) within one hour. In addition, SNL participated in a biological decontamination field test at the U.S. Army Proving Grounds at Dugway, UT. This field test was designed to test the effectiveness of decon formulations in killing spores of an anthrax simulant. Bacillus globigii was deployed using a small explosive device into an area constructed of various surfaces commonly found in a typical office space. Figure 3 shows the test room. Because the area to be decontaminated was relatively small and to show the versatility of the Sandia Decon Formulation, the formulation was deployed by a small portable backpack unit. After 24 hours exposure to the our formulation, the office surfaces were sampled and tested by Dugway personnel for surviving spores. Results from these tests are shown in Figure 4.

SURFACE	CONTAMINATED (Surface average in CFU/in.^{2})	DECONTAMINATED (ND = Not Detected)
Floor (painted concrete)	7.67E+07	ND
Floor (tile)	1.31E+07	ND
Floor (carpet)	1.23E+07	ND
Floor (wood)	7.30E+06	ND
Window (glass)	5.32E+04	ND
Painted wall below window	8.16E+04	ND
Left hand wall panels	4.70E+04	ND
Wall (stucco)	2.80E+05	ND
Painted wall above carpet	4.56E+04	ND
Carpeted wall	1.08E+06	ND
Door	3.13E+04	ND
Ceiling	8.49E+02	ND

Figure 4. B. globigii (anthrax simulant) spore kill during Dugway field tests.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.

Patent Pending

Sandia National Laboratories has applied for a patent for the technology. The U.S. Government retains rights to the technology for U.S. Government use. The U.S. Government has granted SNL the right to license and commercialize the technology.

Commercial Partners

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